

# Mitigating and Modelling Membrane Fouling by Bioactive Mixtures

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## ABSTRACT

In this study the fouling occurring during batch nanofiltration processing for separating phenolic compounds from clear apple juice concentrate was characterised and modelled using various operating parameters. Polysulphone SelRO® spiral wound membranes with a molecular weight cut-off (MWCO) of 1kDa and 0.25kDa were used on a pilot laboratory scale rig. The retention of various compounds including total and individual phenolics, certain types of sugars, soluble fibre and proteins were determined analytically. The effects of temperature (20, 30, 40, & 50°C), pH (2, 3, 4, & 5), transmembrane pressure (5, 10, 15, & 20 bar) and feed concentration (5, 10, 15, 20 °Brix) on permeate flux, fouling and membrane performance were determined. Different types of fouling mechanisms, including reversible and irreversible concentration polarisation, cake formation, pore blocking or a combination of the aforementioned were investigated. Fouling is detected by a decrease in permeate flux with time. The trends in fouling rates are compared to prediction of available fouling models and the fouling mechanism was discussed. It was found that reversible concentration polarisation was the dominant factor and cake formation to be the main irreversible type of fouling. Irreversible fouling was greater at higher pressures and feed concentration but was reduced at higher temperatures. Furthermore, performing diafiltration increased the permeate flux remarkably by reducing the concentration polarisation effect.

**Keywords:** nanofiltration, fouling, polyphenols, modelling, diafiltration

## BIOGRAPHY, SHORT SKETCH

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### Bio

**Dr. Zaid Saleh** is a Senior Scientist and Team Manager for Food & Ingredient Engineering team at Plant and Food Research Limited and also a Senior Lecturer at the Department of Chemical and Materials Engineering, The University of Auckland. He is involved in research on heat exchanger fouling of organic fluids; stability and compatibility of crude oils; asphaltene precipitation and coke formation; processing of functional foods for Wellness; and bio-separation, fractionation and immobilization of proteins and phytochemicals. He is a member of various professional organizations such as the New Zealand Institution of Professional Engineers (IPENZ), the Canadian Society for Chemical Engineering (CSChE), The American Separation and Filtration Society, and the New Zealand Institute of Foods Science and Technology (NZIFST).

He has been the recipient of various awards and honors; he also has written over 60 articles and reports, more than twenty of which are refereed publications. Several of his published works have received international and national awards.